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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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FINAL REPORT

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TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

DENTAL HYGIENIST

078-368

S-54.

U. S. Employment Service in
Cooperation with
Minnesota State Employment Service

TM 001 251

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
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Fall 1952

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR DENTAL HYGIENIST 078.368

S-54

Summary

The General Aptitude Test Battery was administered to 83 Dental Hygiene students enrolled in the Course for Dental Hygienists at the University of Minnesota, Minneapolis, Minnesota. Course work grades were used as the criterion. On the basis of mean scores, standard deviations, correlations with the criterion and course analysis data, Aptitudes G-Intelligence, S-Spatial Aptitude, and P-Form Perception were selected for inclusion in the test norms.

GATB Norms for Dental Hygienist 078.368 - S-54

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Dental Hygienist 078.368.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-54

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1-H CB-1-I CB-1-J	115	G	Part 3 Part 4 Part 6	110
S	CB-1-F CB-1-H	100	S	Part 3	95
P	CB-1-A CB-1-L	115	P	Part 5 Part 7	110

Effectiveness of Norms

The data in Table V indicate that 11 of the 17 poor students, or 65% of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. Moreover, 57 of the 63 students who made qualifying test scores, or 90%, were good students.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Dental Hygienist 078.368.

II. Sample

The GATB, B-1001, was administered to a sample consisting of 83 female students enrolled in the Course for Dental Hygienists at the University of Minnesota. These students comprised two successive classes in the two year course sequence which leads to the degree of graduate Dental Hygienist. Since both classes were at different levels in the course sequence at the time of testing (October 1952) there are some differences in the composition of the two classes with respect to ability.

The students in the first year of the sequence will be referred to as Class A and the students in the second year as Class B. Test data were obtained for 55 of the 61 beginning students in Class A. However, fifty-two students were included in the final sample, because three of the tested students dropped out of the class before any grades were received. Thirty-one of the 33 students in Class B were tested and all 31 were included in the final sample.

The requirements for entrance in the Course in Dental Hygiene are similar to entrance requirements at the freshman level in the School of Liberal Arts at the University of Minnesota. Generally, these requirements are for the student to have a rank of 40th percentile or better on the American Council of Education (ACE) College Entrance Examination or to be in the top ten percent of her high school graduating class.

Students must maintain approximately a "C" average in their course work in the Dental Hygiene sequence. A large number of dropouts occur during and at the end of the first year in the curriculum. Only very few students are eliminated after the first year, most of the selection having already been effected. Consequently, those students tested in their second year of the course sequence (Class B) were a much more select group of students who had maintained the necessary scholastic proficiency in their first year. Those students tested in their first year (Class A) had not as yet been subjected to these academic selection factors and consequently were a relatively unrestricted sample of students in the Dental Hygiene sequence. Seventeen of the 52 students in Class A did not complete the two year course successfully because of academic deficiency. The 35 remaining students in Class A comprise a group similar in academic achievement to the 31 students in Class B. None of the students in Class B failed to complete the second year requirements leading to a degree of graduate Dental Hygienist.

Table II shows the means, standard deviations, ranges, Pearson product-moment correlations with the criterion and standard errors of correlation for age and education.

TABLE II

Means (M), Standard Deviations (σ), Ranges, Pearson Product-Moment Correlations with the Criterion (r) and the Standard Errors of Correlation (σ_r) for Age and Education

Dental Hygienist 078.368

N = 83

	M	σ	Range	r	σ_r
Age (years)*	19.3	1.6	17-28	.059	.111
Education (years)	12.8	0.9	12-15	.272	.102

*N=80. Age data were not available for three second year students.

The data in the above table indicate that there is a correlation significant at the .05 level between education and the criterion. This is probably due to the fact that the second year students are limited to those who have successfully completed the first year course in Dental Hygiene, whereas the first year students comprised the entire class before dropouts had taken effect. There is no significant correlation between age and the criterion. The sample is more homogeneous with respect to age than the range indicates. Only one person in the sample was 28 years of age; the remainder of the sample was between 17 and 21 years of age.

III. Job Description

Job Title: Dental Hygienist 078.368

Job Summary:

Under the supervision of a licensed dentist or director of public health program, engages in dental prophylactic work in dental offices, hospitals, and clinics; teaches mouth hygiene in health departments and schools. May also do dental laboratory work.

Course Description

The following courses are required in the first and second year of the Dental Hygiene course curriculum at the University of Minnesota. Satisfactory completion of these courses leads to the degree of graduate Dental Hygienist.

First Year		Second Year	
Course	Credits	Course	Credits
Elementary Anatomy	4	Assisting in Dentistry	6
Dental Anatomy	6	Dental Prosthesis and Lab.	7
Bacteriology	4	Dental Prophylaxis	6
Composition	9	Dental Health Education	6
Personal Health	2	Office Practice for Dental Hyg.	3
Human Physiology	4	Oral Histology and Pathology	2
Physiological Chemistry	4	General Pathology	1
Dental Prophylaxis	3	Public Health	3
Radiology	2	Oral Diagnosis	1
General Zoology	10	Fundamentals of Speech	6
		Introduction to Sociology	3
		Elementary Psychology	5
		Introduction to Nutrition	2

Additional courses may be taken as electives and in some cases substituted for certain non-technical courses in the sequence. The total number of credits required in the first year is 48 and in the second year 51 credits. More detailed descriptions of those courses most pertinent to the occupation are given below.

Dental Anatomy. A course of lectures, quizzes, examinations, and laboratory instruction. Lectures: dental nomenclature; special attention to definition, spelling, combining and application of terms used in the various divisions of dentistry; study in detail of all deciduous and permanent teeth including calcification, eruption, decalcification and shedding; tooth form, function, stress, occlusion; surrounding and investing tissues are discussed in detail; anomalies. Laboratory instruction; each student is required to make five drawings of each permanent tooth; ten plastine carvings; seven wax carvings and a didactic and wax carving final.

Dental Prophylaxis. Lectures, demonstrations, and practice in the scaling and polishing of the teeth, and the teaching of oral hygiene and home care of the mouth to patients. The work is introduced by practice on manikins followed by practice on patients in the dental infirmary.

Dental Health Education. A lecture and recitation course in the preparation and presentation of oral hygiene material for various ages, groups, and occasions. Included critical analysis of dental literature, audio-visual aids, display and unit projects, and field work in the public schools.

Dental Assisting. Lectures, demonstrations, and practical experience in surgical and dental assisting in operative dentistry, pedodontia, and orthodontia; includes materia medica.

Prosthetic Dentistry and Dental Laboratory. Prosthetic Dentistry: a course of lectures and laboratory instruction. Lectures: instruments and materials used in dental prosthesis; impression materials and their manipulation; cast construction; art base construction; construction of trial plates

for partial and complete dentures; the setting-up of artificial teeth; packing, vulcanizing, curing and polishing dentures and assisting in denture construction. Laboratory instruction: assisting in impression taking; pouring impressions and making casts and models; construction of art bases; construction of trial plates and the setting-up of teeth; occlusion and articulation. Dental Laboratory: a course of lectures and laboratory instruction. Lectures: instruments and materials used in the various branches of dentistry; assistant's laboratory duties in such areas as crown and bridge, operative dentistry, orthodontia, etc; a study of the manipulation of waxes, investments, metals, plastics, porcelains and cements; soldering. Laboratory instruction: the construction of indirect dies from various materials; wax patterns and castings made for all types of cavity preparations; manipulations of porcelain and plastics; soldering of contact; the manipulation of synthetic porcelain and dental cements.

Dental Radiology. A series of lectures and demonstrations on the application of X-rays for dental diagnostic purposes. The course includes the electrophysics of the apparatus, positioning of the films, angulations of the machine, and processing.

IV. Experimental Battery

All of the tests of the GATB, B-1001, were administered to the sample group.

V. Criterion

The criterion for this study consists of honor point ratios based upon course work taken in the first year of the Dental Hygiene course. Honor points were obtained by giving 5 points for each course credit for which a grade of "A" had been obtained, 4 points for each course credit of "B," 3 points for a "C," etc. These honor points were then divided by the number of credits taken by each student to obtain the individual honor point ratio. Grades obtained in all required courses taken in the first year with the exception of Psychology, Sociology and Nutrition were included. Grades in these courses were not included because a number of students had substituted for one of several courses in these areas. Total credits included in the first year Honor Point Ratios are 48.

First year course grades were used as the criterion for Class A because they were the only grades available for Class A; first year course grades were used as the criterion for Class B in order to have comparable criterion data for both classes. The first year grades serve as a good measure of success in this course because most of the selection that is effected in terms of dropouts occurs in the first year of the sequence.

The means, standard deviations and ranges of the Honor Point Ratios based on the first year course grades are shown in Table III for Class A and Class B.

TABLE III

Means (M), Standard Deviations (σ) and Ranges of Honor Point Ratios

Dental Hygienist 078.368

	N	M	σ	Range
Class A	52	3.00	.68	1.46-4.36
Class B	31	3.41	.46	2.70-4.56

The data in Table III bear out the fact that Class B is a more homogeneous group than Class A because the unsuccessful students had already dropped out of Class B. An honor point ratio of 3.0 must be maintained for a student to be considered as having successfully completed the required course work. Although the range for Class B goes a little below 3.0 (2.70), the five students in Class B who had honor point ratios of less than 3.0 for their first year were able to bring their honor point ratios up to a passing level during the second year of the Dental Hygiene sequence. A follow-up of the first year students (Class A) showed that 17 of the 52 students had honor point ratios below 3.0 and dropped out of the course. In view of the fact that these 17 people were not able to complete that course successfully because of poor scholarship, they represented a true low criterion group for the computation of tetrachoric correlation coefficients and application of the Chi Square test to evaluate test norms.

VI. Statistical and Qualitative Analysis

Table IV shows means, standard deviations, Pearson product-moment correlations with the criterion and standard errors of correlation for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE IV

Means (M), Standard Deviations (σ), Pearson Product-Moment Correlations with the Criterion (r) and Standard Errors of Correlation (σ_r) for the Aptitudes of the GATB

Dental Hygienist (079.368
N = 83

Aptitudes	M	σ	r	σ_r
G-Intelligence	124.5	10.6	.475**	.085
V-Verbal Aptitude	118.2	13.0	.242*	.103
N-Numerical Aptitude	119.0	10.4	.273*	.102
S-Spatial Aptitude	121.6	14.8	.439**	.089
P-Form Perception	134.2	13.4	.446**	.088
Q-Clerical Perception	127.3	13.8	.122	.108
A-Aiming	128.0	16.0	.062	.109
T-Motor Speed	118.8	14.5	.073	.109
F-Finger Dexterity	122.8	17.9	.103	.109
M-Manual Dexterity	117.7	18.4	-.036	.110

**Significant at the .01 level
*Significant at the .05 level

The statistical results were interpreted in the light of the course and job analysis data. These data indicated that the following aptitudes measured by the GATB appear to be important for the occupation of Dental Hygienist.

Aptitude G - Intelligence is basic in the job and course analysis for the learning and comprehension of the underlying principles of dental hygiene.

Aptitude V - Verbal Aptitude is involved in reading comprehension, understanding of notes taken from lecture material and facility of expression which are all needed for the learning of a technical profession.

Aptitude S - Spatial Aptitude is required in the recognition and drawing of teeth; making plastine and wax carvings; and constructing trial plates for partial and complete dentures.

Aptitude P - Form Perception is required to perceive pertinent details of the teeth, such as slight anomalies.

Aptitudes F and M - Finger Dexterity and Manual Dexterity are required in all phases of laboratory work and assistance in dental offices.

The highest mean scores, in order of magnitude, were obtained for Aptitudes P, A, Q, and G, respectively. All of the aptitudes have standard deviations of less than 20.

When N = 83, correlations of .281 and .216 are significant at the .01 level and .05 level, respectively. Aptitudes G, S, and P correlate significantly with the criterion at the .01 level, and Aptitudes V and N correlate significantly with the criterion at the .05 level.

On the basis of job and course analysis data, high mean scores and significant correlations with the criterion, Aptitudes G and P were included in the test norms. Aptitude S was included in the test norms on the basis of its high correlation with the criterion and importance for successful performance of the duties of this occupation as indicated by the job and course analyses.

Although there was some statistical and/or qualitative evidence to warrant the inclusion of Aptitudes V, N, Q, A, F, and M, the supporting data for these aptitudes were not as strong as the evidence to support the inclusion of Aptitudes G, S and P in the test norms. Therefore, Aptitudes V, N, Q, A, F and M were omitted from the final test norms.

Several factors were taken into consideration in setting the cutting scores for Aptitudes G, S, and P. The minimum score for Aptitude G was set at one standard deviation below the mean and rounded to the nearest five-point score level. This resulted in a score of 115 for Aptitude G. Although the nearest five-point score level to one standard deviation below the mean on Aptitude S is 105, the cutting score was set at 100 because better predictive value was obtained at this level. There were several conflicts which had to be resolved in setting the cutting score for Aptitude P. One standard deviation below the mean rounded to the nearest five-point score level on Aptitude P yields a score of 120. Norms which include Aptitude P tend to yield the highest predictive value when the cutting score is set at 125. However, a cutting score of 125 on Aptitude P eliminated a higher than appropriate proportion of the sample when consideration was given to the fact that only twenty percent of the sample was found to be unsuccessful. Slightly better selective efficiency was obtained when a cutting score of 115 rather than 120 on Aptitude P was used in combination with G-115 and S-100. When all factors were taken into consideration, the optimum cutting score for Aptitude P was found to be 115.

Follow-up information on this sample showed that 17 of the students were not able to complete the course because of poor scholarship. This information provides us with a true point of demarcation between successful and unsuccessful students. Therefore, for the purpose of computing the tetrachoric correlation coefficient and applying the Chi Square test, the criterion was dichotomized so that those students who successfully completed the course were placed in the high criterion group and the 17 students who were not able to complete the course because of poor scholarship were placed in the low criterion group. Table V shows the relationship between test norms consisting of G-115, S-100 and P-115 and the dichotomized criterion for the sample of 83 students. Students in the high criterion group have been designated as "good students" and those in the low criterion group as "poor students."

TABLE V

Relationship Between Test Norms Consisting of Aptitudes G, S, and P with Critical Scores of 115, 100 and 115, Respectively and the Criterion for Dental Hygienist 078.368

N = 83

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Students	9	57	66
Poor Students	11	6	17
Total	20	63	83

$r_{tet} = .76$ $\quad X^2 = 16.585$

$\sigma r_{tet} = .21$ $\quad P/2 < .001$

The data in the above table indicate a high and significant relationship between the test norms and the criterion for this sample.

VII. Conclusions

On the basis of mean scores, correlations with the criterion, job and course analysis data and their combined predictive efficiency, Aptitudes G, S, and P with minimum scores of 115, 100 and 115, respectively, are recommended as B-1001 norms for the occupation of Dental Hygienist 078.368 The equivalent B-1002 norms consist of G-110, S-95 and P-110.